# Final Report

# QF-4 Phantom Crash Site Assessment

# White Sands National Monument

Contract No.: FA4801-14-P-0055

U.S. AIR FORCE, HOLLOMAN AIR FORCE BASE

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| amsl | Above Mean Sea Level |
| DMC | Deuterated Monitoring Compounds |
| DRO | Diesel Range Organics |
| EPA | U.S. Environmental Protection Agency |
| GPS | Global Positioning System |
| GRO | Gasoline Range Organics |
| mg/kg | Milligrams per Kilogram |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| NMED | New Mexico Environment Department |
| ORO | Oil Range Organics |
| PID | Photoionization Detector |
| ppm | Parts per Million |
| QA/QC | Quality Assurance/Quality Control |
| RCRA | Resource Conservation and Recovery Act |
| SSL | Soil Screening Level |
| SVOC | Semivolatile Organic Compound |
| TestAmerica | TestAmerica Laboratories Incorporated |
| TPH | Total Petroleum Hydrocarbons |
| U.S. | United States |
| USAF | United States Air Force |
| Vernadero | Vernadero Group Incorporated |
| VOC | Volatile Organic Compound |
| WSNM | White Sands National Monument |

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## 1.0 INTRODUCTION

Vernadero Group Incorporated (Vernadero) was selected by the 49th Contract Engineer Squadron at Holloman Air Force Base to provide soil sampling and laboratory analytical investigation activities as a result of the 7 February 2014 crash of a QF-4 Phantom Aircraft on the White Sands National Monument (WSNM). The project was conducted to determine the nature and extent of soil contamination by petroleum hydrocarbons and related constituents resulting from the crash. The project emphasized rapid response to conduct field evaluations and deliver a final report delineating cleanup parameters, minimizing disturbance of the surface and subsurface on the WSNM, and avoiding disturbance of plants, animals, and potential anthropological or archeological items.

### 1.1 Scope of Work

Vernadero obtained 93 soil samples and 7 background samples. Background samples were representative of the range of soil samples collected within the contamination area. Soil samples were obtained at various depths to determine the vertical and lateral extent of potential contamination. The overall effort included setting up a sample grid within the known areas of contamination (node spacing of 50 feet); initial screening using a photoionization detector (PID) to determine contaminant boundaries; soil sampling to determine boundaries and depth of contaminated areas; delineation of areas of known contamination and random sampling of open areas; and recording of sample locations via global positioning system (GPS) for both screening and analytical samples. Field data are summarized in Appendix A on Table A-1. Appendix B includes drawings of the subject site, sample and screening locations, and GPS data provided by the United States (U.S.) Air Force (USAF).

Soil samples were analyzed for total petroleum hydrocarbons to determine gasoline, diesel and oil range organics (U.S. Environmental Protection Agency [EPA] Method 8015M), volatile organic compounds (EPA Method 8260), semivolatile organic compounds (EPA Method 8270) and Resource Conservation and Recovery Act (RCRA) metals (EPA Method 6010). Quality assurance/quality control (QA/QC) sampling was conducted, including 10% duplicates, 20% matrix spikes (MSs) and matrix spike duplicates (MSDs), one trip blank per cooler, and 20% equipment blanks for reusable augers/sampling equipment. Laboratory summary data tables are included in Appendix C. The laboratory report is provided on a separate CD accompanying this report.

### 1.2 Site Identification

The crash site is approximately 2.7 miles northwest of the entrance to WSNM, north of New Mexico Highway 54. A general location map is provided as Figure B-1 in Appendix B. The plane crashed south of and perpendicular to the main access road (Dunes Drive) and continued northward across the road (Drawings B-2 through B-4, Appendix B). The debris field is limited to approximately 615 feet wide and 2,010 feet long, while the area of potential contamination is estimated to be less than 400 feet by 1,800 feet. Significant debris and materials had been

removed by the USAF prior to Vernadero's participation in the project. General photographs of the site are provided as Appendix D.

## 2.0 GEOLOGIC AND HYDROGEOLOGIC SETTING

Fryberger (2001) summarizes the geology and hydrogeology of the WSNM area, as collected from numerous authors and researchers. Geologic and hydrogeologic settings of the site are summarized below (Dane 1965).

### 2.1 Geologic Setting

WSNM is within the Tertiary Rio Grande Rift of Colorado, New Mexico, and Texas. This narrow, elongate zone of extension contains numerous basins, including the Tularosa Basin, where the gypsum dunes of the WSNM have formed from gypsiferous lake deposits. The Tularosa Basin was a depocenter for evaporites, carbonates and clastics during Pennsylvanian through Permian time. During Laramide times of the latest Cretaceous and Paleocene, much of the area of the ancestral Tularosa Basin was compressionally uplifted. In the Tertiary the basin subsided rapidly as a component of the Rio Grande Rift with a half-graben geometry that is deepest on the west near the San Andres Mountains. Tertiary sediments are typical of arid zone rifts and include fluvial, lacustrine, and Aeolian sediments (Fryberger 2001).

Various studies cited by Fryberger (2001) indicate that the primary source of sand for the dune field is the recycling of gypsum crystals from deposits of Pleistocene Lake Otero. Secondary sources include recycling of sand from older dunes and much smaller quantities of gypsum freshly precipitated from the shallow groundwater table.

### 2.2 Hydrogeologic Setting

The WNSM dune fields rest on younger basin fill materials. These fine-grained rocks have very low reported hydraulic conductivity. Water flows downgradient toward the southern part of the Tularosa Basin within sands intercalated with shales. Older consolidated rocks outcropping around the basin edge also conduct groundwater toward the basin. These serve as recharge areas, absorbing precipitation and runoff from the nearby mountains, where rain and snowfall are much greater. Average annual precipitation at WSNM is approximately 9 inches (Fryberger 2001).

Groundwater recharge occurs through permeable basin fill, especially from the alluvial fans, along the edge of the basin. These fans receive fresh water from streams draining the mountains (Fryberger 2001). Groundwater within the subject site is relatively shallow and depends on infiltration of rainwater and stormwater temporarily stored on adjacent playas.

Groundwater was not encountered during this investigation at depths up to approximately 48 inches, although saturated soils exhibiting liquefaction-type properties were encountered at those depths.

### 2.3 Topography

WSNM ranges in elevation from 3,890 to 4,116 feet above mean sea level (amsl). The site is generally situated on a playa with intermittent sand dunes at an elevation of approximately 3,966 to 3,986 feet amsl. Sand dunes adjacent to the site to the south are approximately 40 to 50 feet in elevation higher than the site. The immediate area surrounding the site is at approximately the same elevation as the site, with smaller sand dunes 3 to 7 feet above the playa floor. Runoff from the site would drain northerly toward the playa lakebed.

## 3.0 SITE ASSESSMENT

This section describes the sampling rationale and field methods used to conduct the site assessment. Field activities included soil sampling, location of sample sites and screening locations via GPS, and visual evaluation of surface soils. This section also presents laboratory analyses conducted on the collected soil samples.

### 3.1 Planning

Site assessment activities were conducted from 21 through 24 April 2014 and were based on the initial findings of the crash evaluation conducted by the USAF immediately following the incident in February 2014 (USAF 2014a, 2014b). Soil samples were collected with sampling equipment at depths required to determine the vertical extent of the contamination and were based on provided flame ionization detector/PID screening and provided GPS coordinates.

### 3.2 Sampling Rationale

The approved scope of work called for collection of 93 soil samples and 7 background samples (100 total samples). Additionally, 10% duplicate samples were obtained (10 samples). Sampling locations included areas of known contamination, areas of potential contamination, and areas that appeared to be outside zones of potential contamination. Samples are listed in Appendix A on Table A-1.

Each sampling location was screened at the surface with the PID. The location was then excavated in approximate 3-inch intervals until 12 to 15 inches were excavated, or when no contaminants were detected with the PID or observed visually or by odor. Where PID, visual contamination, or odors were detected, the locations were further excavated until the bottom of the excavation appeared uncontaminated. Where observed contaminants exceeded a depth of about 20 inches, further exploration was conducted by a hand auger to a maximum depth of 48 inches. Two samples were obtained at most sampling locations. A few locations were sampled once, with more contaminated locations yielding three samples.

Background samples were representative of the range of soil samples collected within the USAF-defined contamination area. Background sampling locations were obtained as close to the crash site as possible, but they did not appear to be influenced by site contamination or other anthropogenic sources. Background samples were taken outside the USAF-defined area

of contamination, and an effort was made to match soil types within the contaminated area samples.

For the larger defined areas of contamination, 50-foot grid spacing was established using GPS to screen potential areas of contamination and to delineate areas of known contamination. Screening was conducted using a PID to determine the boundaries of potential contaminants. Sampling and screening locations were recorded via GPS.

### 3.3 Soil Sampling

This section outlines the methods used to collect surface and shallow subsurface soil samples. For this project, surface soils were generally classified as soils between the ground surface and 46 to 48 inches below ground surface, where sample collection using manual collection methods became impractical.

Stainless steel spoons were used for surface soil sampling to maximum depths of 22 inches below ground surface where conditions were generally soft and nonindurated, and with no problematic vegetative layer to penetrate. When the soil being sampled was cohesive and held its *in situ* texture in the spoon, a Loc N' Load™ Handle and syringe was used to collect the subsample for Method 5035 directly from the spoon. If the soil was not cohesive and crumbled when removed from the ground surface for sampling, the sample was plugged directly from the surface or at a depth appropriate for the investigation, in accordance with Method 5035.

A hand auger was used to advance shallow boreholes and collect soil samples between 20 and 48 inches. A 4-inch-diameter stainless-steel auger bucket with a cutting head was used. The bucket was advanced by simultaneously pushing and turning it, using an attached handle with a 4-foot extension. Auger holes are advanced one bucket at a time until the sample depth was achieved, based on negative PID readings.

The auger bucket was then placed in the hole, filled with soil to make up the sample, and removed. The practical depth of investigation using a hand auger was 48 inches. Because of the tendency for the auger bucket to scrape material from the sides of the auger hole while being extracted, the top several inches of soil in the auger bucket were discarded prior to placing the bucket contents in the sample containers for processing. The entire hand auger was decontaminated before it was used at a new sampling location.

Stainless-steel scoops and hand augers were decontaminated prior to use each day and between sampling locations. Samples collected using a stainless-steel scoop or hand auger were transferred into laboratory-provided, precleaned glass jars with Teflon®-lined lids. EPA Method 5035 was employed to obtain methanol preserved samples for analysis by EPA Methods 8260 and 8015 gasoline range organics (GRO), using a clean Loc N' Load™ Handle and new syringe for each sample. Sample containers were labeled, a custody seal affixed across the lid and container body, and documented on a chain-of-custody form. Sample containers were individually bagged, wrapped with bubble wrap (to prevent breakage), and stored in a sample cooler with bagged ice.

Soil samples were hand delivered to TestAmerica Laboratories Inc. (TestAmerica) in Phoenix, Arizona. Prior to submitting the samples to the analytical laboratory, custody seals were affixed to the front of each sample cooler.

## 4.0 LABORATORY ANALYTICAL METHODS

Soil samples and field quality control samples (equipment rinsates and source blanks) were collected in accordance with the approved scope of work. Samples collected during the sampling event of 21 through 24 April 2014 were submitted to TestAmerica of Phoenix, Arizona. TestAmerica's laboratory is certified by the State of New Mexico and Department of Defense. Samples were analyzed by the following methods:

- Total petroleum hydrocarbons as GRO, diesel range organics (DRO), and oil range organics (ORO) using EPA Method 3550B/8015;
- Volatile organic compounds (VOCs) by EPA Method 8260;
- Semivolatile organic compounds (SVOCs) by EPA Method 8270;
- RCRA metals by EPA Method 6010B; and
- Mercury by EPA Method 7470A.

## 5.0 RESULTS

### 5.1 Field Screening

As discussed in Section 3, following sampling and assessment methodologies, all sampling locations and known areas of contamination were screened using a PID. In addition, at each sampling location, soils were screened with the PID throughout the excavated sample point, at intervals of approximately 3 inches, until 12 inches in depth or a reading of zero parts per million (ppm) was observed on the PID.

Results of field screening are detailed in Appendix A. Figure B-3 in Appendix B illustrates the spatial distribution of PID readings and sample locations. Note that not all samples that returned levels of contaminants above laboratory detection limits were observed in the field on the PID; nor did all samples that did have PID readings in the field return laboratory results matching those PID readings.

### 5.2 Laboratory Results

Laboratory results are summarized in Table C-1 in Appendix C. Only the results returned for samples above the laboratory reporting limit for each specific compound are presented on the table. All other results are below laboratory detection limits. Samples that are above State of New Mexico soil screening levels (SSLs) are highlighted in the table. The full laboratory report is provided on a CD in Appendix C.

To summarize results:

- Three soil samples (WSNM-A–005B, WSNM-A-025A, and WSNM-A-034A) and one duplicate sample (WSNM-A-034AD) returned fractional levels of SVOCs (EPA Method

8270C). One compound is not regulated by the New Mexico Environment Department (NMED) or EPA. The remaining compounds show laboratory results significantly below NMED SSLs.

- Nineteen soil samples returned fractional levels of VOCs (EPA Method 8260B). Eight compounds that were reported above detection limits are not regulated by NMED or EPA. Of the remaining five compounds detected, in all but one sample (WSNM-A-011A), laboratory results were significantly below NMED SSLs. Sample WSNM-A-011A contained 11 ppm naphthalene, which is below NMED SSLs of 43 ppm (residential), 241 ppm (industrial/occupational), or 159 ppm (construction worker) levels.
- Eighteen soil samples were reported by the laboratory to contain varying levels of total petroleum hydrocarbons (TPH) as DRO, GRO or ORO (EPA Method 8015M). Ten soil samples exceeded NMED SSLs of either residential or industrial/occupational TPH limits (1,000 or 3,000 ppm). Samples WSNM-A-11A and WSNM-A-15A exceed DRO limits at 1,800 ppm and 1,100 ppm, respectively. Samples WSNM-A-011A, WSNM-A-012A, WSNM-A-014A and -014B, WSNM-A-015A and -015B, WSNM-A-017A, and WSNM-A-018 A and -018B exceeded NMED SSLs for ORO of either residential or industrial/occupational limits (1,000 or 3,000 ppm) from 1,300 ppm to 31,000 ppm. WSNM-A-012B results indicated 960 ppm, which is moderately below NMEDs SSL of 1,000 ppm for residential soils.
- RCRA metals were analyzed by EPA Method 6010B and mercury by EPA Method 7471A. Laboratory results indicate that arsenic, cadmium, lead, selenium, and silver were not observed above detection limits. Barium ranged from 16 to 87 ppm, while chromium ranged from 4.0 to 9.5 ppm (although chromium was not detected in four samples). Values for both barium and chromium are similar throughout all samples analyzed and can be considered natural background levels.

Multiple samples contain various VOC, SVOC, and TPH compounds above laboratory detection limits. Of those samples, 10 samples exceeded NMED SSLs for TPH.

## 6.0 QUALITY CONTROL

This section discusses the field and laboratory QC samples and data validation.

### 6.1 Field Quality Control

Field QC samples included equipment rinsates, source blanks, duplicate samples, and background samples. Laboratory results for all QC samples provided on a CD in Appendix C.

#### *6.1.1 Duplicate and Background Samples*

Ten duplicate and seven background samples were obtained for the project, per the scope of work. Comparison of analytical results for original and duplicate samples indicate virtually identical results for compounds detected, indicating the efficacy of laboratory procedures and results.

Background sample results yielded no observed contaminants above laboratory detection limits. This indicates that the 93 field samples can be reasonably judged to reflect actual levels of contaminants, or lack thereof, as they exist at the subject site.

### *6.1.2 Equipment Rinsate*

Equipment rinsates are a sample of analyte-free, distilled water collected from a final rinse of sampling equipment after the decontamination procedure has been conducted. The purpose of the equipment rinsate is to determine the effectiveness of the decontamination procedure and potential for cross-contamination during sampling events. Equipment rinsates were analyzed for the same analytes as all field samples. As specified in the scope of work, 20 rinsate samples were obtained through the sampling effort.

Seven rinsate samples from 21 and 22 April yielded low levels of TPH (less than 3.8 ppm), with no other contaminants reported above laboratory detection limits. The 13 rinsate samples from 23 and 24 April did not report laboratory results above detection limits for any compounds of interest. Based on the location of the decontamination station within or near zones of contaminated soils, and the high winds experienced during the periods prior to sampling of rinsates, it is possible that rinsate waters were slightly contaminated with low levels of TPH-contaminated sand and dust. Laboratory results for TPH in soil samples preceding acquisition of the rinsate samples are significantly higher than the results in the rinsate samples, or are below laboratory detection limits. Those results are therefore judged not to have been affected by cross-contamination from the decontamination process. No soil samples show levels of TPH similar to those in any rinsate samples.

### *6.1.3 Trip Blanks*

Trip blank samples were provided by the laboratory and consisted of analyte-free, reagent-grade water used for evaluation of shipping and laboratory sources of contamination. Twenty trip blanks were provided by the laboratory and were analyzed for VOCs only. Trip blanks were free of observed contaminants; therefore no data were qualified based on this field QC criterion.

### *6.1.4 Laboratory Quality Control*

Laboratory QC samples included MS/MSD samples. The MS/MSD samples were analyzed by the laboratory at a frequency of approximately 1 of 20 samples. MS/MSD samples were used to assess the sample matrix effect on the extraction efficiency of analytes of concern.

## 6.2 Data Quality

Data verification included review of the hard-copy data reports to assure that the data correctly represented the analytical measurement and complied with QA/QC goals, identify nontechnical errors in the data package (e.g., typographical errors), and verify that sample identifiers on the laboratory's hard-copy reports matched those on the chain-of-custody forms. The review also verified that the required field and laboratory documentation was included in the data package.

Sample results were internally validated generally following the *Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99-008 (EPA 1999), and *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540-R-04-004 (EPA 2004). QC limits were specified by TestAmerica. Data qualifiers are listed in the laboratory report included on CD in Appendix C and are applied to the affected data.

TestAmerica identified two QC issues:

1) QC failures associated with analysis for SVOCs by Method 8270C; and
2) Analysis after holding times had expired for DRO by Method 8015B.

TestAmerica notes that the above QA/QC issues indicate the following, based on the data and industry-standard data validation practices as represented in the EPA's *National Functional Guidelines for Superfund Organic Methods Data Review* (2008):

- **Method 8270C QC failures:** Surrogate spike recoveries for the method blank were 0% to 3%. This is almost certainly a spiking error, rather than a systematic problem with 8270C recoveries because the surrogate spike recoveries for associated samples were all within limits.

  As stated in the *National Functional Guidelines*:

  > In the special case of a blank analysis having DMCs [deuterated monitoring compounds] out of specification, the reviewer must give special consideration to the validity of associated sample data. The basic concern is whether the blank problems represent an isolated problem with the blank alone, or whether there is a fundamental problem with the analytical process. For example, if one or more samples in the batch show acceptable DMC recoveries, the reviewer may choose to consider the blank problem to be an isolated occurrence.

- **Method 8015B DRO Analysis Outside Holding Time:** Samples were collected from 21 through 24 April 2014. The samples were received on 25 April 2014 in good condition at temperatures less than or equal to 6 degrees Centigrade. The organic extractions were performed on 9 and 10 May 2014, 15 to 18 days after collection, whereas the technical holding time is 14 days from the day of sample collection to the day of analysis. The holding time was not grossly exceeded; therefore, the DRO results might be subject to a slight negative bias, particularly for the lighter molecular weight components. Normal validation guidelines in this circumstance would be to qualify detects with a "J" and nondetects as estimated with an approximated "UJ."

TestAmerica indicates that the final report of Method 8270C SVOC results and Method 8015B DRO results contains reliable analytical information.

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

The following discussion presents the conclusions and recommendations of the QF-4 Phantom crash site assessment.

### 7.1 Conclusions

Multiple areas within the defined crash site polygon contain identified contaminants at varying levels. Contaminants have been identified as primarily petroleum hydrocarbons via EPA Method 8015 for TPH in DRO, GRO, or ORO. Additional field screening efforts with a PID, visual, and odor assessments of stained areas further delineated potential areas of concern.

Areas of concern are illustrated in Appendix B, Figure B-4. Tables 7-1 and 7-2 summarize each identified area of contamination. Areas listed in Table 7-1 are defined as zones of contamination above background levels, but less than NMED SSL's for residential soil (between 0 PPM and <1,000 PPM TPH). Areas listed in Table 7-2 are defined as zones of contamination above NMED SSL's for residential soil (>1,000 PPM TPH). For defined areas that include both zones of TPH contaminants (Areas P-1 and P-2) total volume is calculated for areas below <1,000 PPM TPH by subtracting areas >1,000 PPM TPH that are within the same polygon.

**Table 7-1. Areas of Contamination Between Background and SSL (0 to <1,000 ppm TPH)**

| Remediation Areas (refer to Figure B-4, noted in yellow) | Estimated Excavation Depth (inches) | Estimated Excavation Area (square feet) | Estimated Remediation Volume (cubic yards) |
|---|---|---|---|
| P1 | 20 | 11,129 | 688 |
| P2 | 18 | 10,760 | 598 |
| P3 | 30 | 10,686 | 989 |
| P4 | 18 | 3 | 1 |
| P5 | 12 | 3 | 1 |
| | | **Total** | **2,277** |

**Table 7-2. Areas of Contamination Above SSL (> 1,000 ppm TPH)**

| Remediation Areas (refer to Figure B-4, noted in yellow) | Estimated Excavation Depth (inches) | Estimated Excavation Area (square feet) | Estimated Remediation Volume (cubic yards) |
|---|---|---|---|
| P1 | 48 | 5,930 | 879 |
| P2 | 40 | 5,402 | 666 |
| | | **Total** | **1,545** |

### 7.2 Recommendations

Soils in areas exceeding NMED guidelines must be removed and restored. Approximate volumes as defined by field and laboratory data are provided in Tables 7-1 and 7-2. Two options for mitigation of impacted soils appear viable:

1. Removal of all soils with contaminants detected above background levels (the total volume of soils in Tables 7-1 and 7-2), which is calculated at a total volume of **3,822 cubic yards**); or
2. Removal of soils with contaminants detected above Residential Soil SSLs of 1,000 PPM TPH (volume in Table 7-2, only), which is calculated at a total volume of **1,545 cubic yards**).

All contaminated soils removed from the site should be properly disposed of at a licensed disposal facility. It is recommended that an independent third party verify that soils removed are contaminated, are removed from specified areas, and that excavated areas are verified to be below identified remediation levels (either item 1 or item 2 above) via field screening, and closure sampling and laboratory analysis.

## 8.0 CLOSURE

The findings presented herein are based upon observations of our field personnel, points of investigation, and results of laboratory tests conducted by subcontracted laboratories. Vernadero has conducted the work described in this report within the limits prescribed by the scope of work using the usual degree of care and thoroughness normally employed by the environmental consulting profession at the time and locality in which the study was completed.

Conclusions presented in this report are professional opinions based solely upon observations of our field personnel, points of investigation, and results of services provided by state-licensed/certified contractors. The scope of work conducted in execution of this investigation may not be appropriate to satisfy the needs of other users, and any use of this document or the findings, conclusions, or recommendations presented herein is at the sole risk of the said third party.

Opinions and recommendations presented apply to the conditions that existed at the time of our investigation and cannot necessarily apply to site changes of which Vernadero is unaware and has not had the opportunity to evaluate. Site conditions may be affected by natural processes or by the works of man. Changes in applicable standards and regulations may also occur as a result of legislation or the broadening of knowledge. Consequently, the findings of this report may be invalidated, wholly or in part, by changes that are unforeseen and beyond our control.

## 9.0 REFERENCES

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# Appendix A. Field Data

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**Table A-1. Summary of Field Sample Data.**

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-000 | 4 | 0.0 | A | 24-Apr-14 | 1320 | Light tan sandy silt | SCT | Background sample. |
| WSNM-A-001 | 0 | 0.0 | | 22-Apr-14 | 0815 | Tan to buff silty sand | DEA | No odor or discoloration. |
| | 3 | 0.1 | A | 22-Apr-14 | 0825 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 0835 | Tan to buff silty sand | | No odor. |
| WSNM-A-002 | 0 | 0.1 | | 22-Apr-14 | 0855 | Tan to buff silty sand | DEA | Slight hydrocarbon odor. |
| | 3 | 0.1 | A | 22-Apr-14 | 0905 | Tan to buff silty sand | | No odor or discoloration. |
| | 6 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 0920 | Tan to buff silty sand | | No odor. |
| WSNM-A-003 | 0 | 0.0 | | 22-Apr-14 | 0925 | Tan to buff silty sand | DEA | No odor or discoloration. |
| | 3 | 0.0 | A | 22-Apr-14 | 0930 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 0945 | Tan to buff silty sand | | No odor. |
| WSNM-A-004 | 0 | 0.0 | | 22-Apr-14 | 0955 | Tan to buff silty sand | DEA | No odor or discoloration. |
| | 3 | 0.0 | A | 22-Apr-14 | 1005 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 1020 | Tan to buff silty sand | | No odor. |
| WSNM-A-005 | 0 | 0.0 | | 21-Apr-14 | | Tan silty sand | DEA | Slight oily stain at surface. |
| | 3 | 2.9 | | 21-Apr-14 | | Tan silty sand | | Slight hydrocarbon odor. |
| | 6 | 3.4 | | 21-Apr-14 | | Tan silty sand | | Slight hydrocarbon odor. |
| | 9 | 4.0 | A | 21-Apr-14 | | Tan silty sand | | Slight hydrocarbon odor. |
| | 12 | 0.2 | | 21-Apr-14 | | Tan silty sand | | Slight hydrocarbon odor. |
| | 15 | 0.0 | B | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 18 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-006 | 0 | 0.0 | A | 21-Apr-14 | 1430 | Tan silty sand | SCT | No discoloration. No odor. |
| | 6 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 12 | 0.0 | B | 21-Apr-14 | 1450 | Tan silty sand | | No odor. |
| WSNM-A-007 | 0 | 0.0 | | 21-Apr-14 | | Tan silty sand | SCT | No discoloration. No odor. |
| | 6 | 0.0 | Sample | 21-Apr-14 | 1330 | Tan silty sand | | No odor. |
| WSNM-A-008 | 0 | 0.0 | | 21-Apr-14 | 1415 | Tan silty sand | DEA | No odor or discoloration. |
| | 3 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 6 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 9 | 0.0 | A | 21-Apr-14 | 1425 | Tan silty sand | | No odor. |
| | 12 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 15 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 18 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| WSNM-A-009 | 0 | 0.0 | | 21-Apr-14 | 1535 | Tan silty sand | DEA | No odor or discoloration. |
| | 3 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 6 | 0.0 | A | 21-Apr-14 | 1545 | Tan silty sand | | No odor. |
| | 9 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 12 | 0.0 | B | 21-Apr-14 | 1600 | Tan silty sand | | No odor. |
| | 15 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| WSNM-A-010 | 0 | 0.0 | | 21-Apr-14 | 1455 | Tan silty sand | DEA | No odor or discoloration. |
| | 3 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 6 | 0.0 | A | 21-Apr-14 | 1505 | Tan silty sand | | No odor. |
| | 9 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| | 12 | 0.0 | B | 21-Apr-14 | 1515 | Tan silty sand | | No odor. |
| | 15 | 0.0 | | 21-Apr-14 | | Tan silty sand | | No odor. |
| WSNM-A-011 | 0 | 0.0 | | 22-Apr-14 | 1120 | Tan silty sand | DEA | Strong hydrocarbon odor. |
| | 3 | 22.5 | A | 22-Apr-14 | 1130 | Tan silty sand | | Strong hydrocarbon odor. |
| | 6 | 30.4 | | 22-Apr-14 | | Tan silty sand | | Strong hydrocarbon odor. |
| | 9 | 17.2 | | 22-Apr-14 | | Tan silty sand | | Strong hydrocarbon odor. |
| | 12 | 15.2 | | 22-Apr-14 | | Tan silty sand | | Strong hydrocarbon odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-011 | 15 | 2.7 | | 22-Apr-14 | | Tan silty sand | | Strong hydrocarbon odor. |
| | 18 | 1.0 | | 22-Apr-14 | | Tan silty sand | | Slight hydrocarbon odor. |
| | 20 | 0.0 | B | 22-Apr-14 | 1145 | Tan silty sand | | No odor. |
| WSNM-A-012 | 0 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | DEA | Stained cocoa brown, no odor. |
| | 3 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | | No odor. |
| | 6 | 0.0 | A | 21-Apr-14 | 1700 | Light tan sandy silt | | No odor. |
| | 9 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 21-Apr-14 | 1715 | Light tan sandy silt | | No odor. |
| | 15 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | | No odor. |
| | 18 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | | No odor. |
| WSNM-A-013 | 0 | 1.0 | | 21-Apr-14 | 1550 | Light tan sandy silt | DEA | Base of impact crater, slight stain and odor. |
| | 2 | 3.2 | | 21-Apr-14 | | Light tan sandy silt | | Slight hydrocarbon odor. |
| | 6 | 23.6 | | 21-Apr-14 | | Light tan sandy silt | | Strong hydrocarbon odor. |
| | 9 | 39.9 | | 21-Apr-14 | | Light tan sandy silt | | Strong hydrocarbon odor. |
| | 15 | 47.7 | | 21-Apr-14 | | Light tan sandy silt | | Strong hydrocarbon odor. |
| | 20 | 48.5 | A | 21-Apr-14 | 1820 | Light tan sandy silt | | Strong hydrocarbon odor. |
| | 24 | 4.7 | | 21-Apr-14 | | Light tan sandy silt | | Slight hydrocarbon odor. |
| | 28 | 3.8 | | 21-Apr-14 | | Light tan sandy silt | | Slight hydrocarbon odor. Soil is damp and cohesive. |
| | 34 | 2.2 | | 21-Apr-14 | | Light tan sandy silt | | Slight hydrocarbon odor. Soil is wet. |
| | 40 | 0.8 | | 21-Apr-14 | | Light tan sandy silt | | Slight hydrocarbon odor. Soil is saturated with water. |
| | 45 | 0.0 | B | 21-Apr-14 | 1800 | Light tan sandy silt | | No odor. Soil is saturated with water. |
| | 48 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | | No odor. Soil is saturated with water. |
| WSNM-A-014 | 0 | 0.0 | | 22-Apr-14 | | Light tan sandy silt | SCT | Slightly stained soil, no odor. |
| | 6 | 16.6 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 12 | 24.5 | A | 22-Apr-14 | 1245 | Light tan sandy silt | | No odor. |
| | 18 | 11.5 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 22 | 0.0 | B | 22-Apr-14 | 1300 | Light tan sandy silt | | No odor. |
| WSNM-A-015 | 0 | 0.0 | | 22-Apr-14 | | Light tan sandy silt | SCT | Slightly stained soil, no odor. |
| | 6 | 15.6 | A | 22-Apr-14 | 1125 | Light tan sandy silt | | No odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-015 | 12 | 23.4 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 18 | 5.1 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 22 | 0.8 | B | 22-Apr-14 | 1140 | Light tan sandy silt | | No odor. |
| WSNM-A-016 | 0 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | SCT | Slight hydrocarbon odor. |
| | 5 | 0.0 | A | 21-Apr-14 | 1750 | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 21-Apr-14 | 1810 | Light tan sandy silt | | No odor. |
| WSNM-A-017 | 0 | 0.0 | A | 21-Apr-14 | 1540 | Light tan sandy silt | SCT | No discoloration. No odor. |
| | 6 | 0.0 | B | 21-Apr-14 | 1550 | Light tan sandy silt | | No odor. |
| WSNM-A-018 | 0 | 0.0 | | 21-Apr-14 | | Light tan sandy silt | SCT | Dark stain. No odor. |
| | 6 | 1.0 | A | 21-Apr-14 | 1645 | Light tan sandy silt | | No odor. |
| | 12 | 8.8 | | 21-Apr-14 | | Light tan sandy silt | | No odor. |
| | 18 | 0.5 | | 21-Apr-14 | | Light tan sandy silt | | No odor. |
| | 22 | 0.5 | B | 21-Apr-14 | 1715 | Light tan sandy silt | | No odor. |
| WSNM-A-019 | 0 | 0.0 | | 22-Apr-14 | | Light tan sandy silt | SCT | Slightly stained, slight hydrocarbon odor. |
| | 6 | 0.0 | A | 22-Apr-14 | 0935 | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 0950 | Light tan sandy silt | | No odor. |
| | 20 | 0.0 | C | 22-Apr-14 | 1010 | Light tan sandy silt | | No odor, evidence of moisture. |
| WSNM-A-020 | 0 | 0.0 | A | 22-Apr-14 | 1240 | Light tan sandy silt | DEA | No discoloration. No odor. |
| | 3 | 0.0 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | 1245 | Light tan sandy silt | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 1300 | Light tan sandy silt | | No odor. |
| WSNM-A-021 | 0 | 0.0 | | 23-Apr-14 | 0805 | Light tan sandy silt | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 23-Apr-14 | 0815 | Light tan sandy silt | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Light tan sandy silt | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 0830 | Light tan sandy silt | | No odor. |
| WSNM-A-022 | 0 | 0.0 | | 22-Apr-14 | 1405 | Brown to tan silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 22-Apr-14 | 1410 | Brown to tan silty sand | | No odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-022 | 6 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 15 | 0.0 | | 22-Apr-14 | 1425 | Brown to tan silty sand | | No odor. |
| WSNM-A-023 | 0 | 0.0 | | 22-Apr-14 | | Light tan sandy silt | SCT | Slightly stained soil, no odor. |
| | 6 | 0.0 | A | 22-Apr-14 | 1545 | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 1600 | Light tan sandy silt | | No odor. |
| WSNM-A-024 | 0 | 0.0 | | 22-Apr-14 | 1320 | Brown to tan silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 22-Apr-14 | 1330 | Brown to tan silty sand | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 1345 | Brown to tan silty sand | | No odor. |
| WSNM-A-025 | 0 | 3.3 | | 22-Apr-14 | | Light tan sandy silt | SCT | Slightly stained soil, no odor. |
| | 6 | 81.2 | A | 22-Apr-14 | 1405 | Light tan sandy silt | | No odor. |
| | 12 | 140.0 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 19 | 34.9 | | 22-Apr-14 | | Light tan sandy silt | | No odor. |
| | 21 | 21.6 | | 22-Apr-14 | | Light tan sandy silt | | No odor, evidence of moisture. |
| | 30 | 19.6 | | 22-Apr-14 | | Light tan sandy silt | | No odor, saturated with water. |
| | 39 | 0.5 | B | 22-Apr-14 | 1445 | Light tan sandy silt | | No odor, saturated with water. |
| WSNM-A-026 | 0 | 0.0 | | 22-Apr-14 | 1445 | Brown to tan silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 22-Apr-14 | 1450 | Brown to tan silty sand | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 1505 | Brown to tan silty sand | | No odor. |
| WSNM-A-027 | 0 | 0.0 | | 23-Apr-14 | 0835 | Brown to tan silty sand | DEA | Slight odor and discoloration. |
| | 3 | 0.0 | A | 23-Apr-14 | 0840 | Brown to tan silty sand | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 0855 | Brown to tan silty sand | | No odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-028 | 0 | 0.0 | | 23-Apr-14 | | Brown to tan silty sand | SCT | No odor. |
| | 3 | 0.0 | A | 23-Apr-14 | 1000 | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | B | 23-Apr-14 | 1010 | Brown to tan silty sand | | No odor. |
| WSNM-A-029 | 0 | 0.0 | | 22-Apr-14 | 1535 | Brown to tan silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 22-Apr-14 | 1540 | Brown to tan silty sand | | No odor. |
| | 6 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 22-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 22-Apr-14 | 1550 | Brown to tan silty sand | | No odor. |
| WSNM-A-030 | 0 | 0.0 | | 23-Apr-14 | 0950 | Tan silty sand | DEA | Slight odor and discoloration. |
| | 3 | 0.5 | A | 23-Apr-14 | 0955 | Light tan sandy silt | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Light tan sandy silt | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Light tan sandy silt | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 1002 | Light tan sandy silt | | No odor. |
| WSNM-A-031 | 0 | 0.0 | | 23-Apr-14 | 1105 | Tan to buff silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.1 | A | 23-Apr-14 | 1115 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 1125 | Tan to buff silty sand | | No odor. |
| WSNM-A-032 | 0 | 0.0 | | 23-Apr-14 | | Light tan sandy silt | SCT | No discoloration. No odor. |
| | 3 | 0.0 | A | 23-Apr-14 | 1115 | Light tan sandy silt | | No odor. |
| | 3 | 0.0 | AD | 23-Apr-14 | 1120 | Light tan sandy silt | | No odor. |
| | 6 | 0.0 | B | 23-Apr-14 | 1130 | Light tan sandy silt | | No odor. |
| WSNM-A-033 | 0 | 0.0 | | 23-Apr-14 | | Light tan sandy | SCT | No odor. |
| | 6 | 0.0 | A | 23-Apr-14 | 1155 | Light tan sandy | | No odor. |
| | 9 | 0.0 | B | 23-Apr-14 | 1210 | Light tan sandy | | No odor. |
| WSNM-A-034 | 0 | 0.5 | | 23-Apr-14 | 1415 | Tan to buff silty sand | DEA | Strong hydrocarbon odor. Slight discoloration. |
| | 3 | 20.6 | A | 23-Apr-14 | 1425 | Tan to buff silty sand | | Strong odor. |
| | 3 | 20.6 | AD | 23-Apr-14 | 1425 | Tan to buff silty sand | | Strong odor. |
| | 6 | 48.2 | | 23-Apr-14 | | Tan to buff silty sand | | Strong odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-034 | 9 | 31.4 | | 23-Apr-14 | | Tan to buff silty sand | | Strong odor. |
| | 12 | 0.5 | B | 23-Apr-14 | 1445 | Tan to buff silty sand | | No odor. |
| WSNM-A-035 | 0 | 0.0 | A | 23-Apr-14 | 1230 | Tan to buff silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | | 23-Apr-14 | 1235 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 1245 | Tan to buff silty sand | | No odor. |
| WSNM-A-036 | 0 | 0.0 | | 23-Apr-14 | 1525 | Tan to buff silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 23-Apr-14 | 1530 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 1540 | Tan to buff silty sand | | No odor. |
| WSNM-A-037 | 0 | 0.0 | | 23-Apr-14 | 1450 | Tan to buff silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 23-Apr-14 | 1455 | Tan to buff silty sand | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Tan to buff silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 1500 | Tan to buff silty sand | | No odor. |
| WSNM-A-038 | 0 | 0.0 | | 23-Apr-14 | 1138 | Brown to tan silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 23-Apr-14 | 1145 | Brown to tan silty sand | | No odor. |
| | 6 | 0.0 | | 23-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 23-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 1155 | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | BD | 23-Apr-14 | 1200 | Brown to tan silty sand | | No odor. |
| WSNM-A-039 | 0 | 1.5 | | 24-Apr-14 | 1145 | Brown to tan silty sand | DEA | One-foot-diameter petroleum, oil, and lubricant stain. Slight odor. |
| | 3 | 6.0 | A | 24-Apr-14 | 1150 | Brown to tan silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 24-Apr-14 | 1200 | Brown to tan silty sand | | No odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-040 | 0 | 0.0 | | 23-Apr-14 | 1230 | Brown to tan silty sand | SCT | No odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 1240 | Buff silty sand | | No odor. |
| | 3 | 0.0 | AD | 24-Apr-14 | 1250 | Brown silty sand | | No odor. |
| | 9 | 0.0 | B | 24-Apr-14 | 1300 | Brown silty sand | | No odor. |
| WSNM-A-041 | 0 | 0.0 | | 23-Apr-14 | | Brown to tan silty sand | SCT | No discoloration. No odor. |
| | 6 | 0.0 | A | 23-Apr-14 | 0930 | Brown to tan silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 0940 | Brown to tan silty sand | | No odor. |
| WSNM-A-042 | 0 | 0.0 | | | 0915 | Buff silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 0920 | Buff silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | B | 23-Apr-14 | 0930 | Brown to tan silty sand | | No odor. |
| WSNM-A-043 | 0 | 0.0 | | 24-Apr-14 | 1105 | Brown to tan silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 1115 | Buff silty sand | | No odor. |
| | 3 | 0.0 | AD | 24-Apr-14 | 1115 | Buff silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | B | 24-Apr-14 | 1125 | Brown silty sand | | No odor. |
| WSNM-A-044 | 0 | 0.0 | | 24-Apr-14 | 0820 | Buff silty sand | DEA | Bottom of initial impact furrow. Top of soil 26 inches below average surface surrounding site. No discoloration. Slight odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 0825 | Buff silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | B | 24-Apr-14 | 0835 | Brown silty sand | | No odor. |
| | 12 | 0.0 | BD | 24-Apr-14 | 0835 | Brown silty sand | | No odor. |
| WSNM-A-045 | 0 | 0.0 | | 24-Apr-14 | 0745 | Buff silty sand | DEA | Bottom of initial impact furrow. Top of soil 16 inches below average surface surrounding site. No discoloration. No odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 0755 | Buff silty sand | | No odor. |

| Location Number | Depth (inches) | PID Reading (ppm) | Sample Designation | Date | Time | Soil Description | Field Sampler | Notes |
|---|---|---|---|---|---|---|---|---|
| WSNM-A-045 | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | B | 24-Apr-14 | 0805 | Brown silty sand | | No odor. |
| WSNM-A-046 | 0 | 0.0 | A | 24-Apr-14 | 0915 | Buff silty sand | DEA | Bottom of initial impact furrow. Top of soil 8 inches below average surface surrounding site. No discoloration. No odor. |
| | 3 | 0.0 | | 24-Apr-14 | | Buff silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | B | 24-Apr-14 | 0925 | Brown silty sand | | No odor. |
| WSNM-A-047 | 0 | 0.0 | | 24-Apr-14 | 0940 | Buff silty sand | DEA | Slight surface discoloration. No odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 0945 | Buff silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | B | 24-Apr-14 | 0955 | Brown silty sand | | No odor. |
| WSNM-A-048 | 0 | 0.0 | | 24-Apr-14 | 1235 | Buff silty sand | DEA | No discoloration. No odor. |
| | 3 | 0.0 | A | 24-Apr-14 | 1250 | Buff silty sand | | No odor. |
| | 6 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 9 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| | 12 | 0.0 | | 24-Apr-14 | | Brown silty sand | | No odor. |
| WSNM-A-049 | 4 | 0.0 | A | 24-Apr-14 | 0915 | Light tan sandy silt | SCT | Background sample. |
| | 4 | 0.0 | AD | 24-Apr-14 | 0920 | Light tan sandy silt | | Background sample. |
| WSNM-A-050 | 4 | 0.0 | A | 24-Apr-14 | 1000 | Light tan sandy silt | SCT | Background sample. |
| WSNM-A-051 | 4 | 0.0 | A | 24-Apr-14 | 1030 | Light tan sandy silt | SCT | Background sample. |
| WSNM-A-052 | 4 | 0.0 | A | 24-Apr-14 | 1100 | Light tan sandy silt | SCT | Background sample. |
| | 4 | 0.0 | AD | 24-Apr-14 | 1105 | Light tan sandy silt | SCT | Background sample. |
| WSNM-A-053 | 4 | 0.0 | A | 24-Apr-14 | 1150 | Light tan sandy silt | SCT | Background sample. |
| WSNM-A-054 | 4 | 0.0 | A | 24-Apr-14 | 1250 | Light tan sandy silt | SCT | Background sample. |

**DEA** – Dean Eduard Alford, **PID** – photoionization detector, **SCT** – Sean Clinton Turner

FORMAT PAGE

# Appendix B. Drawings

FORMAT PAGE

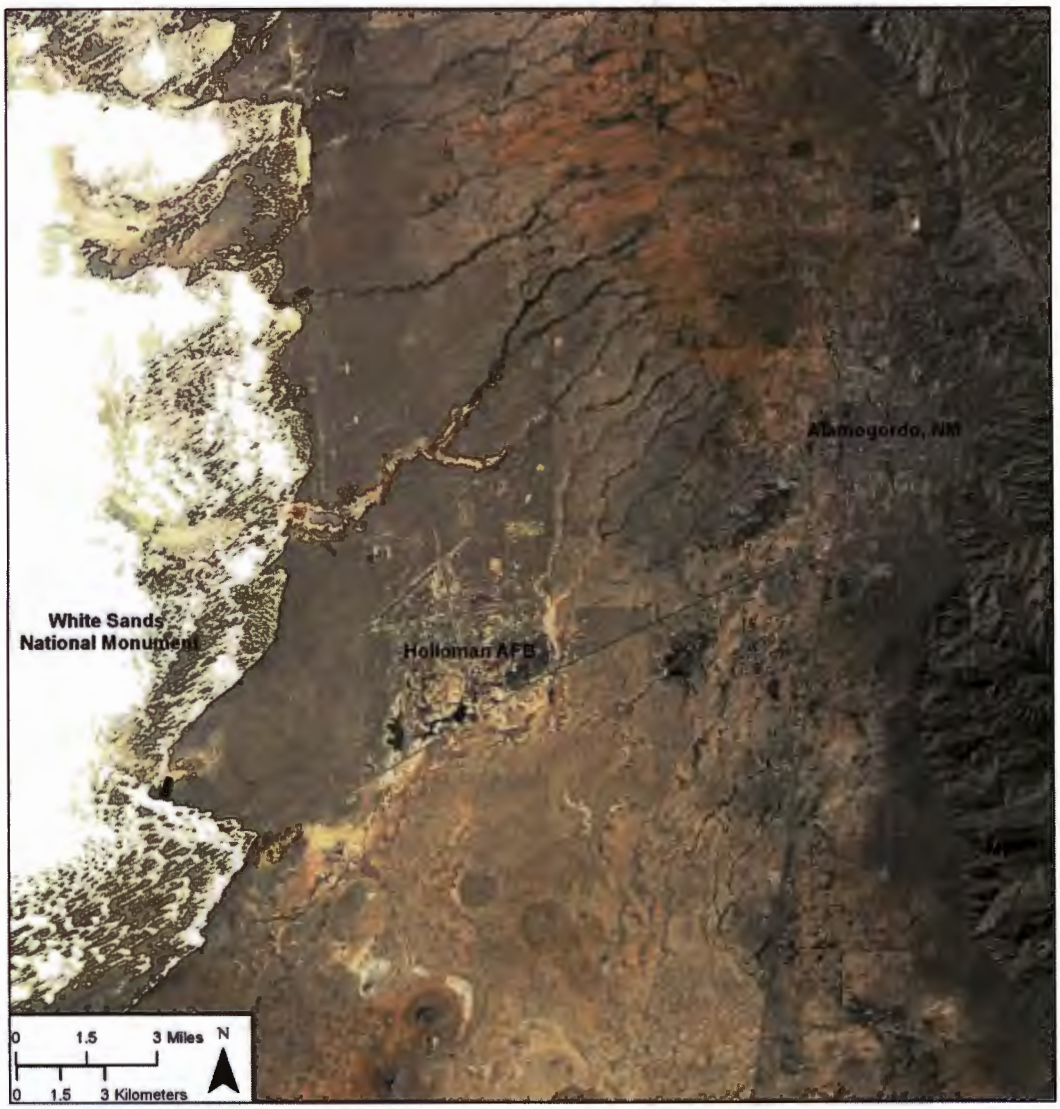


**Figure B-1. Regional Map**

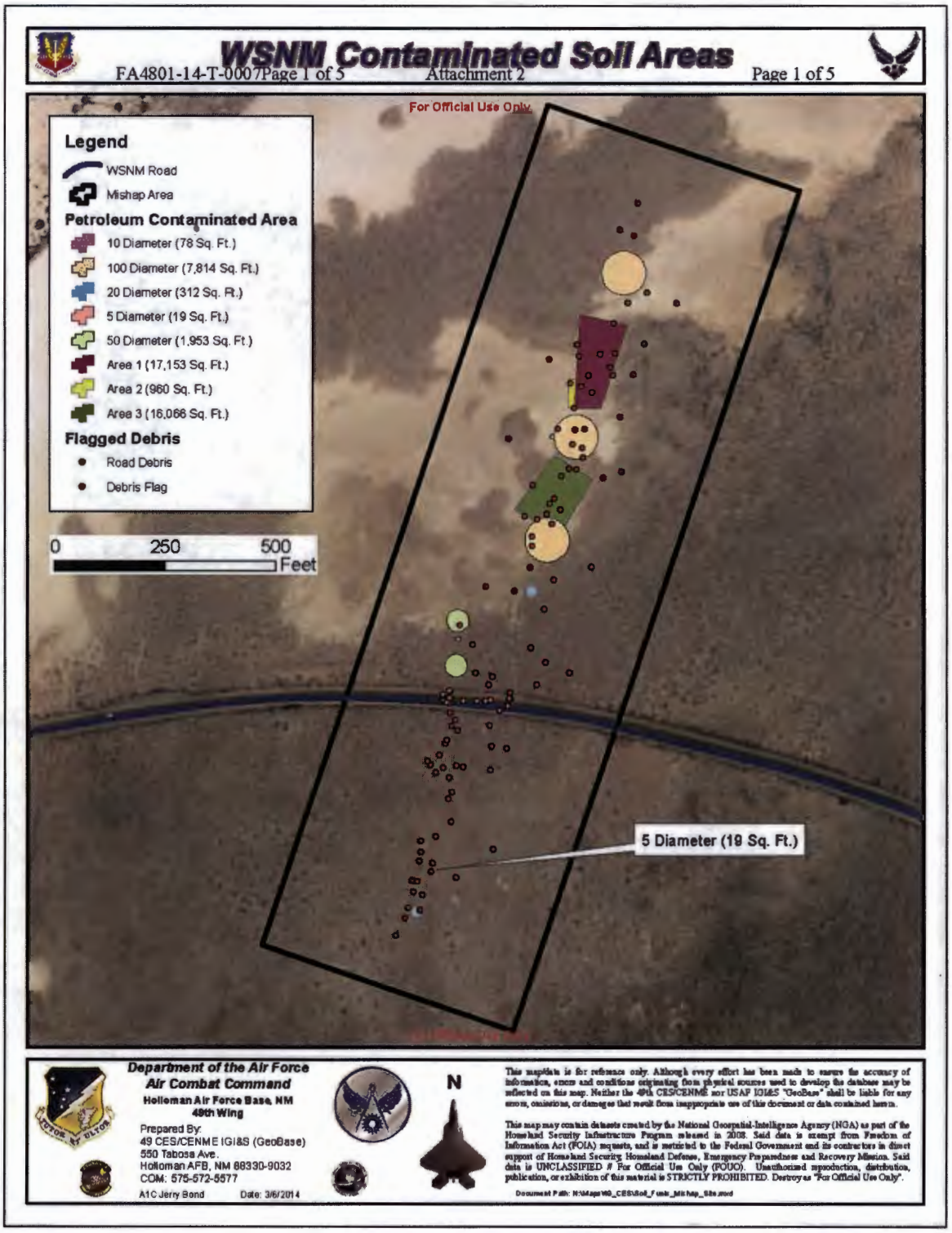


**Figure B-2. USAF Mapped Contamination and Debris Points**

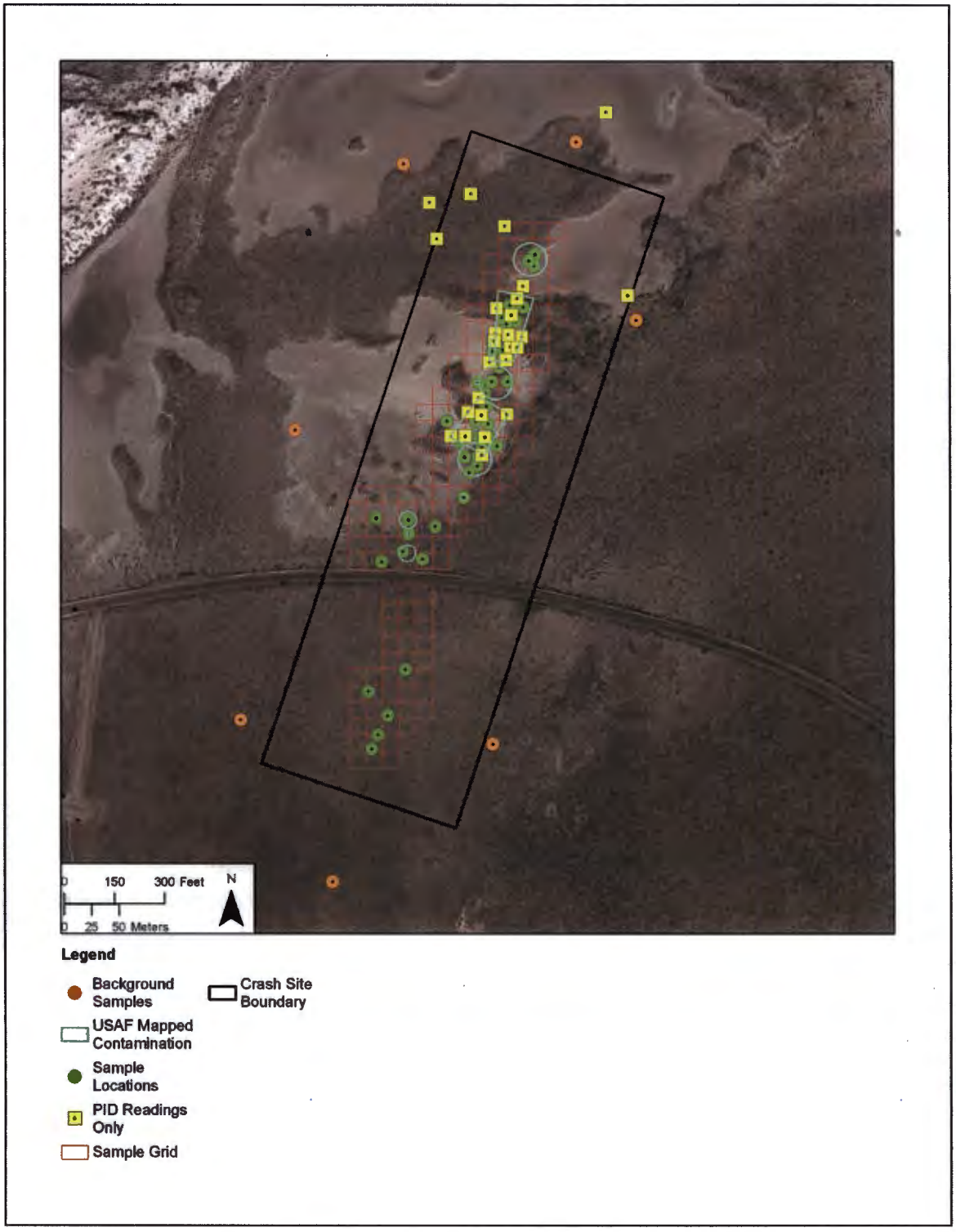


**Figure B-3. Map of Sampled and PID Measured Locations**

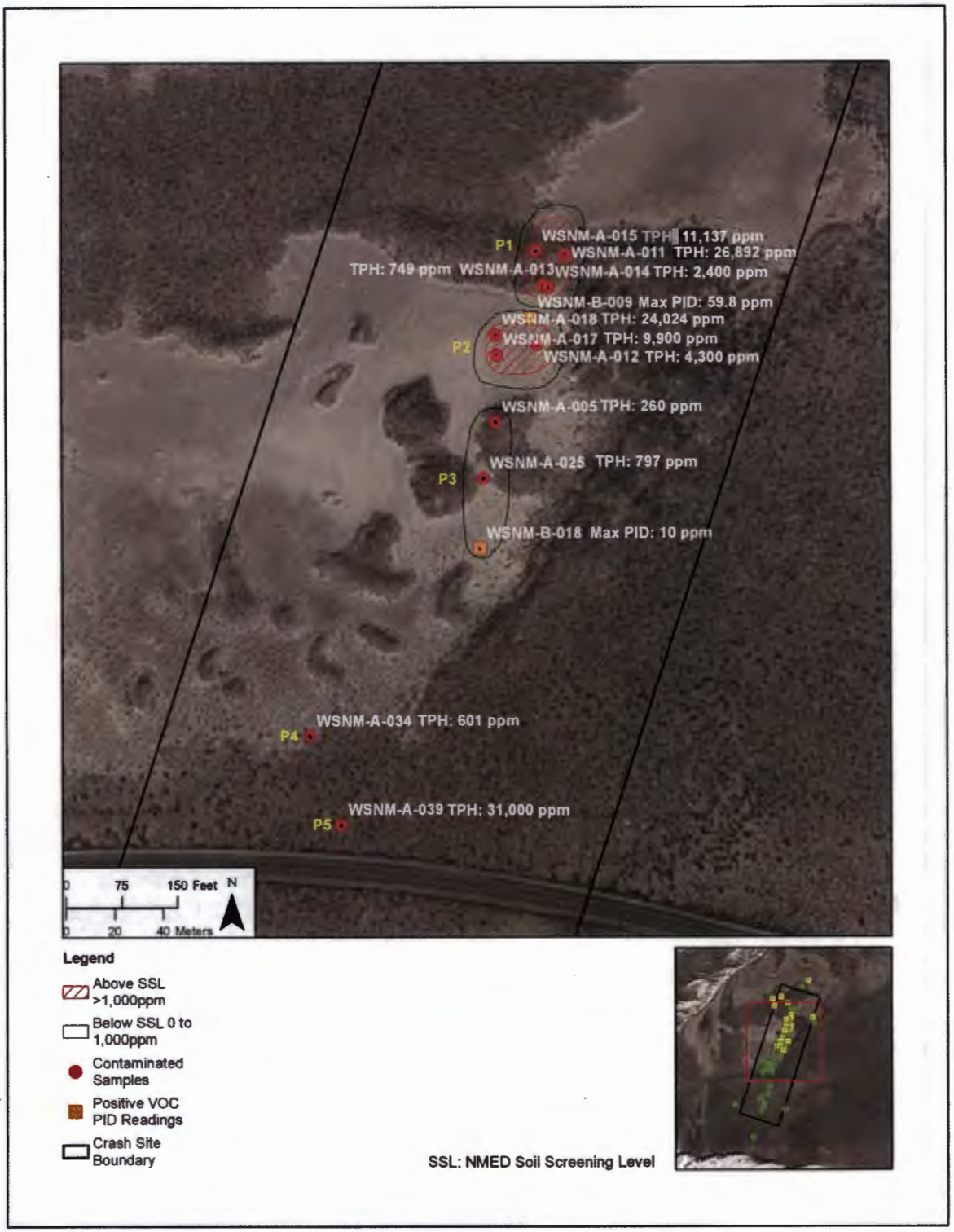


**Figure B-4. Map of Contaminated Samples and Positive PID Readings**

# Appendix C. Laboratory Results

FORMAT PAGE

**Table C-1. Summary of Samples Above Laboratory Reporting Limit**

| Analytical Method | Analyte | NMED Soil Screening Levels (NMED 2012) | | | Sample Number (Laboratory Results in PPM) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Residential Soil (mg/kg = ppm) | Industrial/ Occupational Soil (mg/kg=ppm) | Construction Worker Soil (mg/kg=ppm) | WSNM-A-034A | WSNM-A-034AD | WSNM-A-034B | WSNM-A-039A | WSNM-A-012A | WSNM-A-012B | WSNM-A-013A | WSNM-A-014B | WSNM-A-018A | WSNM-A-018B | WSNM-A-025A | WSNM-A-015A | WSNM-A-015B | WSNM-A-014A | WSNM-A-005A | WSNM-A-005B | WSNM-A-017A | WSNM-A-017B | WSNM-A-011A |
| EPA 8260B – Volatile Organic Compounds (mg/kg = ppm) | 1,2,4-Trimethylbenzene | | | | 1.70 | 2.80 | 0.56 | | | | 0.13 | | 1.70 | 0.81 | 2.70 | 3.00 | 0.27 | 0.32 | | | | | |
| | 1,3,5-Trimethylbenzene | | | | 0.40 | 0.71 | 0.15 | | | | | | 0.47 | 0.22 | 0.59 | 0.64 | | | | | | | 5.50 |
| | 2-Hexanone | | | | | | | | | | | | | | | 2.10 | | | | | | | |
| | Ethylbenzene | 88 | 378 | 1,830 | | | | | | | | | 0.15 | | | | | | | | | | |
| | Isopropylbenzene | | | | | | | | | | | | 0.12 | | | | | | | | | | 0.25 |
| | m-Xylene and p-Xylene | 774 | 3,780 | 705 | | | | | | | | | 0.56 | 0.33 | | | | | | | | | 0.53 |
| | Naphthalene | 43 | 241 | 158 | 1.80 | 2.70 | | | | | | | | | 1.50 | 3.10 | 0.47 | | | | | | 11.00 |
| | n-Butylbenzene | | | | 0.45 | 0.71 | | | | | | | | | 0.89 | 0.95 | | | | | | | 7.80 |
| | N-Propylbenzene | | | | 0.16 | | | | | | | | 0.25 | 0.12 | | 0.19 | | | | | | | 1.10 |
| | o-Xylene | 898 | 4,410 | 823 | | | | | | | | | 0.28 | 0.16 | | | | | | | | | 0.30 |
| | 4-Isopropyltoluene | | | | 0.19 | 0.32 | | | | | | | 0.15 | | 0.40 | 0.39 | | | | | | | 3.80 |
| | sec-Butylbenzene | | | | | | | | | | | | | | | | | | | | | | 2.40 |
| | Xylenes, Total | 814 | 3,980 | 743 | | | | | | | | | 0.84 | 0.49 | | | | | | | | | 0.83 |
| EPA 8270C – Semivolatile Organic Compounds (mg/kg = ppm) | Bis(2-ethylhexyl) phthalate | 347 | 1,370 | 4,760 | | | | | | | | | | | | | | | | 0.37 | | | |
| | Naphthalene | 43 | 241 | 158 | | 0.65 | | | | | | | | | 0.84 | | | | | | | | |
| | 2-Methylnaphthalene | | | | 4.3 | 6.2 | | | | | | | | | 2.7 | | | | | | | | |

| Analytical Method | Analyte | NMED Soil Screening Levels (NMED 2012) | | | Sample Number (Laboratory Results in PPM) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Residential Soil (mg/kg = ppm) | Industrial/ Occupational Soil (mg/kg=ppm) | Construction Worker Soil (mg/kg=ppm) | WSNM-A-034A | WSNM-A-034AD | WSNM-A-034B | WSNM-A-039A | WSNM-A-012A | WSNM-A-012B | WSNM-A-013A | WSNM-A-014B | WSNM-A-018A | WSNM-A-018B | WSNM-A-023A | WSNM-A-015A | WSNM-A-015B | WSNM-A-014A | WSNM-A-005A | WSNM-A-005B | WSNM-A-017A | WSNM-A-017B | WSNM-A-011A |
| EPA 8015M – GRO (mg/kg = ppm) | TPH - GRO | NA | NA | NA | 61 | 58 | | | | | | | 24 | | 37 | 37 | | | | | | | 92 |
| | TPH - DRO | **1,000** | **3,000** | NA | 540 | 540 | 36 | | | | 39 | | | | 760 | **1,100** | | | 120 | 55 | | | **1,800** |
| | TPH - ORO | **1,000** | **3,000** | NA | | | | **31,000** | **4,300** | 960 | 710 | **1,300** | **24,000** | **14,000** | | **11,000** | **1,400** | **2,400** | 140 | 110 | **9,900** | 260 | **25,000** |
| | Total TPH | | | | 601 | 596 | 36 | 31,000 | 4,300 | 960 | 749 | 1,300 | 24,024 | 14,000 | 797 | 11,137 | 1,400 | 2,400 | 260 | 165 | 9,940 | 260 | 26,892 |

**NMED** – New Mexico Environment Department; **PPM** – parts per million; **mg** – milligram; **kg** – kilogram; **EPA** – U.S. Environmental Protection Agency; **NA** – not applicable

**Key:** **Bold numbers** – Results exceed New Mexico Soil Screening Levels; [redacted] – not applicable – material is not listed by either EPA or NMED with a SSL.

**Notes:** EPA 8015 TPH DRO and ORO Soil Screening Levels (SSLs) from NMED 2012, Table 6-3, p. 55; EPA 8015 GRO, 8270 and 8260 SSLs from NMED 2012, Appendix A, Table A-1; Laboratory results via EPA 8270C reported by laboratory in micrograms per kilogram equal parts per billion (µg/kg = ppb), converted to ppm for comparison to NMED SSLs.

**Background Samples:** WSNM-A-000, WSNM-A-049, WSNM-A-050, WSNM-A-051, WSNM-A-052, WSNM-A-053, WSNM-A-054 laboratory results are all below detection limits.

# Appendix D. Selected Photographs

FORMAT PAGE

**Figure D-1. Overview of Crash Site (provided by USAF)**

**Figure D-2. Typical Sampling Location**


**Figure D-3. Typical Sampling Location with Sample Number and GPS Location**

**Figure D-4. Sample Location, Base of Impact Crater, North Polygon**

**Figure D-5. Typical Decontamination Location**

**Figure D-6. Typical Sample Location, South Polygon**

**Figure D-7. Sample Location Using Hand Auger**

**Figure D-8. Typical Polygon Area**

**Figure D-9. Typical Background Sample Location, North of Impact Area**

**Figure D-10. Sample Location, Base of Impact Crater, North Polygon**

**Figure D-11. Sample Locations, North of Access Road**


**Figure D-12. Typical Sample Location, South of Access Road**

NEW MEXICO
ENVIRONMENT DEPARTMENT

ENTERED

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Cabinet Secretary
BUTCH TONGATE
Deputy Secretary

**CERTIFIED MAIL - RETURN RECEIPT REQUESTED**

July 16, 2015

DeAnna M. Rothhaupt
Chief, Holloman AFB Environmental
49th CES/CEIE
550 Tabosa Avenue
Holloman AFB, NM 88330

**RE: APPROVAL**
**FINAL LONG-TERM MONITORING PLAN DP-030/SD-033,**
**HOLLOMAN AIR FORCE BASE, NEW MEXICO, JUNE 2015**
**HOLLOMAN AIR FORCE BASE, EPA ID# NM6572124422**
**HWB-HAFB-14-017**

Dear Ms. Rothhaupt:

The New Mexico Environment Department (NMED) has reviewed the work plan: *Final Long-Term Monitoring Plan DP-030/SD-033, Holloman Air Force Base, New Mexico, June 2015,* which was received on June 18, 2015. This work plan revised the *Final Long-Term Monitoring Plan DP-030/SD-033, Holloman Air Force Base, New Mexico,* dated November 2014. The subject work plan is approved.

If you have any questions regarding this letter, please contact Mr. Brian Salem of my staff at (505) 222-9576.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
W. Moats, NMED HWB
B. Salem, NMED HWB
C. Amindyas, NMED HWB
D. Strasser, NMED HWB
D. Rizzuto, HAFB
C. Hendrickson, EPA Region 6 (6PD-F)
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File: HAFB 2015 and Reading
HWB-HAFB-14-017